

Claims

1. A method for compiling assistance data for transmission to a mobile terminal of a wireless communications network, said terminal having an associated satellite positioning system receiver, said method including;

5 determining which satellites of a satellite positioning system constellation are potentially visible to the mobile terminal;

determining on the basis of at least one predetermined criterion the likelihood that each of the potentially visible satellites will actually be used by the mobile terminal when determining its position; and

10 selecting a plurality of satellites from the potentially visible satellites having the greatest likelihood that the mobile terminal will use that satellite when determining its position;

compiling assistance data to be transmitted to the mobile terminal for the selected satellites.

15 2. The method of claim 1 wherein the likelihood that each of the potentially visible satellites will be used by the mobile terminal when determining its position is determined based, at least in part, on the angle of elevation of a satellite relative to the mobile terminal.

3. The method of claim 2 which further includes,
20 determining an approximate position of the mobile terminal; and
determining the approximate elevation of each satellite relative to the approximate position.

4. The method of claim 3 in which the approximate position of the mobile terminal is determined using at least one of the following position indicators associated
25 with the mobile terminal;

cell identification, timing advance, signal strength, round-trip time.

5. The method of claim 1 wherein the likelihood that each of the potentially visible satellites will be used by the mobile terminal when determining its position is determined based, at least in part, on a terrain indicator indicative of a terrain type assigned to a geographical area in which the mobile terminal is located.

5 6. The method of claim 5 in which the number of potentially visible satellites selected is determined at least in part on the terrain indicator for the geographical area in which the mobile terminal is located.

7. The method of claim 1 wherein the likelihood that each of the potentially visible satellites will be used by the mobile terminal when determining its position is determined based, at least in part, on an elevation model of a geographical area in which the mobile terminal is located.

8. The method of claim 7 which includes;
determining which of the potentially visible satellites are actually visible based on the elevation model of the geographical area in which the mobile terminal is located; and
15 selecting the plurality of satellites for which assistance data is compiled from the actually visible satellites.

9. The method of claim 1 wherein the likelihood that each of the potentially visible satellites will be used by the mobile terminal when determining its position is determined based, at least in part, on the geometrical spread of potentially visible satellites in the sky.

10. The method of claim 1 in which selecting the plurality of satellite for which assistance data is compiled from the potentially visible satellites, includes
selecting a subset of the potentially visible satellites that will minimises the position dilution of precision of the location measurement to be performed by the mobile
25 terminal.

11. The method of claim 10 in which the selected subset of satellites includes less than the number of potentially visible satellites.

12. The method of claim 1 wherein the likelihood that each of the potentially visible satellites will be used by the mobile terminal when determining its position is determined based, at least in part, on historical data relating to the probability of a mobile terminal achieving a successful location determination when in the geographical area of the mobile terminal.

13. The method of claim 12 in which selecting the plurality of satellites for which assistance data is compiled from the potentially visible satellites, includes

determining a likelihood that the mobile terminal will successfully determine its location using its associated satellite positioning system receiver, and

determining the number of satellites for which assistance data should be transmitted to the mobile terminal based at least in part on the determined likelihood of successful location determination.

14. The method of claim 13 in which the determined number of satellites includes less than the number of potentially visible satellites.

15. The method of claim 1 wherein the likelihood that each of the potentially visible satellites will be used by the mobile terminal when determining its position is determined based on a plurality of criteria selected from a group including the following:

the angle of elevation of a satellite relative to the mobile terminal;

a terrain indicator indicative of a terrain type assigned to a geographical area in which the mobile terminal is located;

an elevation model of a geographical area in which the mobile terminal is located;

the geometrical spread of potentially visible satellites in the sky; and

historical data relating to the probability of a mobile terminal achieving a successful location determination when in the geographical area of the mobile terminal.

16. A method for compiling assistance data for transmission to a mobile terminal of a wireless communications network said terminal having an associated satellite positioning system receiver, said method including;

identifying a set of satellites that could potentially be used by the mobile terminal when determining its position and for which assistance data can be sent to the mobile terminal;

5 determining a likelihood that each of the identified satellites will not be used by the mobile terminal when determining its position; and

excluding one or more satellites from the identified set of satellites on the basis of said determined likelihood that the satellites will not be used by the mobile terminal when determining its position; and

10 compiling assistance data for the identified set of satellites for transmission to the mobile terminal.

17. The method of claim 16 wherein determining the likelihood that each of the identified satellites will not be used by the mobile terminal when determining its position, includes;

determining an approximate position of the mobile terminal.

15 18. The method of claim 17 wherein the approximate position of the mobile terminal is determined using at least one of the following position indicators associated with the mobile terminal;

cell identification, timing advance, signal strength, round trip time.

20 19. The method as claimed in claim 16 wherein the method includes, determining the number of satellites for which assistance data should be transmitted to the mobile terminal.

20. The method of claim 19 wherein determining the number of satellites for which assistance data should be transmitted to the mobile terminal, is based on one or more of the following criteria:

25 the geometrical spread of potentially visible satellites in the sky;

a terrain indicator indicative of a terrain type assigned to a geographical area in which the mobile terminal is located; and

historical data relating to the probability of a mobile terminal achieving a successful location determination when in the geographical area of the mobile terminal.

21. The method of claim 16 wherein satellites are excluded from the identified set of satellites on the basis of one or more of the following criteria:

- 5 the angle of elevation of a satellite relative to the mobile terminal;
- a terrain indicator indicative of a terrain type assigned to a geographical area in which the mobile terminal is located;
- an elevation model of a geographical area in which the mobile terminal is located;
- the geometrical spread of potentially visible satellites in the sky; and

10 historical data relating to the probability of a mobile terminal achieving a successful location determination when in the geographical area of the mobile terminal.

22. A network element for a wireless telecommunication network configured to compile assistance data for transmission to a mobile terminal of the wireless communications network for use by said mobile terminal when using an associated
15 satellite positioning system receiver to determine its location,

 said network element including a processor configured to determine, which satellites of a satellite positioning system constellation are potentially visible to the mobile terminal, and on the basis of at least one predetermined criterion, to determine the likelihood that each of the potentially visible satellites will actually be used by the mobile
20 terminal when determining its position, the processor further being configured to select a plurality of satellites from the potentially visible satellites having the greatest likelihood that the mobile terminal will use that satellite when determining its position, and compile assistance data to be transmitted to the mobile terminal for the selected satellites.

23. The network element of claim 22 wherein the at least one predetermined
25 criterion used by the processor to determine the likelihood that each of the potentially visible satellites will actually be used by the mobile terminal when determining its position, is selected from a list including:

- an angle of elevation of a satellite relative to the mobile terminal;

a terrain indicator indicative of a terrain type assigned to a geographical area in which the mobile terminal is located;

an elevation model of a geographical area in which the mobile terminal is located;

a geometrical spread of potentially visible satellites in the sky; and

5 historical data relating to the probability of a mobile terminal achieving a successful location determination when in the geographical area of the mobile terminal.

24. A method for transmitting assistance data to a mobile terminal of a wireless communications network said terminal having an associated satellite positioning system receiver, said method including:

10 determining which satellites of a satellite positioning system constellation are potentially visible to the mobile terminal;

determining on the basis of at least one predetermined criterion the likelihood that each of the potentially visible satellites will actually be used by the mobile terminal when determining its position; and

15 selecting a plurality of satellites from the potentially visible satellites having the greatest likelihood that the mobile terminal will use that satellite when determining its position;

transmitting assistance data to the mobile terminal for the selected satellites.

20 25. The method of claim 24 which further includes determining an approximate position of the mobile terminal.

26. The method of claim 25 in which the approximate position of the mobile terminal is determined using at least one of the following position indicators associated with the mobile terminal;

cell identification, timing advance, signal strength, round-trip time.

25 27. The method of claim 24 wherein the likelihood that each of the potentially visible satellites will be used by the mobile terminal when determining its position is determined based on at least one criterion selected from a group including the following:

an angle of elevation of a satellite relative to the mobile terminal;

a terrain indicator indicative of a terrain type assigned to a geographical area in which the mobile terminal is located;

an elevation model of a geographical area in which the mobile terminal is located;

5 a geometrical spread of potentially visible satellites in the sky; and

historical data relating to the probability of a mobile terminal achieving a successful location determination when in the geographical area of the mobile terminal.

28. A method for transmitting assistance data to a mobile terminal of a wireless communications network said terminal having an associated satellite positioning system receiver, said method including:

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identifying a set of satellites that could potentially be used by the mobile terminal when determining its position and for which assistance data can be sent to the mobile terminal;

determining a likelihood that each of the identified satellites will not be used by the mobile terminal when determining its position; and

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excluding one or more satellites from the identified set of satellites on the basis of said determined likelihood that the satellites will not be used by the mobile terminal when determining its position; and

transmitting assistance data to the mobile terminal for the identified set of satellites.

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29. The method of claim 28 wherein determining the likelihood that each of the identified satellites will not be used by the mobile terminal when determining its position, includes determining an approximate position of the mobile terminal.

30. The method of claim 29 wherein the approximate position of the mobile terminal is determined using at least one of the following position indicators associated with the mobile terminal;

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cell identification, timing advance, signal strength, round trip time.

31. The method as claimed in claim 28 wherein the method includes, determining the number of satellites for which assistance data should be transmitted to the mobile terminal.

32. The method of claim 28 wherein satellites are excluded from the identified set of satellites on the basis of one or more of the following criteria:

an angle of elevation of a satellite relative to the mobile terminal;

a terrain indicator indicative of a terrain type assigned to a geographical area in which the mobile terminal is located;

an elevation model of a geographical area in which the mobile terminal is located;

a geometrical spread of potentially visible satellites in the sky; and

historical data relating to the probability of a mobile terminal achieving a successful location determination when in the geographical area of the mobile terminal.

33. A method for transmitting assistance data to a mobile terminal of a wireless communications network said terminal having an associated satellite positioning system receiver, said method including:

receiving an assistance data dataset representing assistance data for a plurality of satellites selected from a set of potentially visible satellites that have the greatest likelihood that the satellites in the plurality will actually be used by the mobile terminal when determining its position; and

transmitting the assistance dataset to the mobile terminal.

34. The method of claim 33 wherein the likelihood that each of the satellites in the plurality will actually be used by the mobile terminal is determined on the basis at least one of the following criterion:

an angle of elevation of a satellite relative to the mobile terminal;

a terrain indicator indicative of a terrain type assigned to a geographical area in which the mobile terminal is located;

an elevation model of a geographical area in which the mobile terminal is located;

a geometrical spread of potentially visible satellites in the sky; and

historical data relating to the probability of a mobile terminal achieving a successful location determination when in the geographical area of the mobile terminal.

35. A method of transmitting assistance data to a mobile terminal of a wireless communications network said terminal having an associated satellite positioning system receiver, said method including:

receiving an initial dataset including assistance data relating to a plurality of satellites in the global positioning satellite constellation that could potentially be used by the mobile terminal when determining its position;

10 excluding assistance data from the initial dataset relating to one or more satellites to generate a reduced set of assistance data; and

transmitting the reduced set of assistance data to the mobile terminal.

36. The method of claim 35 further comprising:

15 determining a likelihood that each of the satellites will not be used by the mobile terminal when determining its position; and

excluding one or more satellites from the identified set of satellites on the basis of said determined likelihood that the satellites will not be used by the mobile terminal when determining its position.

20 37. The method of claim 36 wherein the likelihood that each of the satellites will not be used by the mobile terminal when determining its position, is determined on the basis of at least one of the following criterion:

an angle of elevation of a satellite relative to the mobile terminal;

a terrain indicator indicative of a terrain type assigned to a geographical area in which the mobile terminal is located;

25 an elevation model of a geographical area in which the mobile terminal is located;

a geometrical spread of potentially visible satellites in the sky; and

historical data relating to the probability of a mobile terminal achieving a successful location determination when in the geographical area of the mobile terminal.

38. A network element for a wireless telecommunication network configured to transmit assistance data to a mobile terminal of the wireless communications network for use by said mobile terminal when using an associated satellite positioning system receiver to determine its location,

said network element including a processor configured to determine which satellites of a satellite positioning system constellation are potentially visible to the mobile terminal, and to determine on the basis of at least one predetermined criterion the likelihood that each of the potentially visible satellites will actually be used by the mobile terminal when determining its position, the processor further being configured to select a plurality of satellites from the potentially visible satellites having the greatest likelihood that the mobile terminal will actually use that satellite when determining its position, and to compile assistance data to be transmitted to the mobile terminal for the selected satellites;

the network element further including a transmitter configured to communicate the assistance data to the mobile terminal.

39. The network element of claim 38 wherein the at least one predetermined criterion used by the processor to determine the likelihood that each of the potentially visible satellites will actually be used by the mobile terminal when determining its position, is selected from a list including:

an angle of elevation of a satellite relative to the mobile terminal;

a terrain indicator indicative of a terrain type assigned to a geographical area in which the mobile terminal is located;

an elevation model of a geographical area in which the mobile terminal is located;

a geometrical spread of potentially visible satellites in the sky; and

historical data relating to the probability of a mobile terminal achieving a successful location determination when in the geographical area of the mobile terminal.

40. The network element of claim 39 wherein the transmitter is configured to communicate the assistance data to the mobile terminal via at least one further network element.

5 41. A network element for a wireless telecommunication network configured to transmit assistance data to a mobile terminal of the wireless communications network for use by said mobile terminal when using an associated satellite positioning system receiver to determine its location, the network element including:

10 a receiver configured to receive an initial dataset including assistance data relating to a plurality of satellites in the global positioning satellite constellation that could potentially be used by the mobile terminal when determining its position;

a processor configured to exclude assistance data from the received initial dataset that relates to one or more satellites, thereby generating a reduced set of assistance data; and

15 a transmitter for communicating the reduced set of assistance data to the mobile terminal.

42. The network element of claim 41 wherein the processor is configured to exclude data relating to one or more satellites from the initial data set on the basis of a determined likelihood that assistance data relating to each of the satellites will not be used by the mobile terminal when determining its position.

20 43. The network element of claim 42 wherein the likelihood that the assistance data relating to each of the satellites will be used by the mobile terminal when determining its position, is determined by the processor on the basis of at least one of the following criterion:

25 an angle of elevation of a satellite relative to the mobile terminal;

a terrain indicator indicative of a terrain type assigned to a geographical area in which the mobile terminal is located;

an elevation model of a geographical area in which the mobile terminal is located;

the geometrical spread of potentially visible satellites in the sky; and

historical data relating to the probability of a mobile terminal achieving a successful location determination when in the geographical area of the mobile terminal.

44. The network element of claim 43 wherein the transmitter is configured to communicate the reduced set of assistance data to the mobile terminal via at least one further network element.

45. A telecommunications network including a network element configured to determine what assistance data to send to a mobile terminal of the network for use by said mobile terminal in determining its position using an associated satellite positioning system receiver, on the basis of a determined likelihood that each of the satellites that could potentially be used by the mobile terminal when determining its position will actually be used by the mobile terminal when determining its position.

46. The telecommunication network of claim 45 wherein the network element determines the likelihood that each of the satellites will actually be used by the mobile terminal to determine its position on the basis of at least one of the following criterion:

- an angle of elevation of a satellite relative to the mobile terminal;
- a terrain indicator indicative of a terrain type assigned to a geographical area in which the mobile terminal is located;
- an elevation model of a geographical area in which the mobile terminal is located;
- a geometrical spread of potentially visible satellites in the sky; and

historical data relating to the probability of a mobile terminal achieving a successful location determination when in the geographical area of the mobile terminal.

47. A computer readable medium storing thereon a computer program, said program being configured in use to control the operation of a processor to compile assistance data for transmission to a mobile terminal of a wireless communications network, having an associated satellite positioning system receiver, by performing the steps of:

determining which satellites of a satellite positioning system constellation are potentially visible to the mobile terminal;

determining on the basis of at least one predetermined criterion the likelihood that each of the potentially visible satellites will actually be used by the mobile terminal when determining its position; and

5 selecting a plurality of satellites from the potentially visible satellites having the greatest likelihood that the mobile terminal will use that satellite when determining its position;

compiling assistance data to be transmitted to the mobile terminal for the selected satellites.

10 48. The computer readable medium of claim 47 wherein in use the computer program causes the processor to determine the likelihood that each of the potentially visible satellites will be used by the mobile terminal when determining its position based, at least in part, on the angle of elevation of a satellite relative to the mobile terminal.

15 49. The computer readable medium of claim 47 wherein in use the computer program causes the processor to determine an approximate position of the mobile terminal.

50. The computer readable medium of claim 49 in which the approximate position of the mobile terminal is determined using at least one of the following position indicators associated with the mobile terminal;

cell identification, timing advance, signal strength, round-trip time.

20 51. The computer readable medium of claim 49 wherein in use the computer program causes the processor to determine the likelihood that each of the potentially visible satellites will be used by the mobile terminal when determining its position based, at least in part, on a terrain indicator indicative of a terrain type assigned to a geographical area in which the mobile terminal is located.

25 52. The computer readable medium of claim 49 wherein in use the computer program causes the processor to determine the likelihood that each of the potentially visible satellites will be used by the mobile terminal when determining its position based,

at least in part, on an elevation model of a geographical area in which the mobile terminal is located.

53. The computer readable medium of claim 49 wherein in use the computer program causes the processor to determine the likelihood that each of the potentially visible satellites will be used by the mobile terminal when determining its position based, at least in part, on the geometrical spread of potentially visible satellites in the sky.

54. The computer readable medium of claim 49 wherein in use the computer program causes the processor to determine the likelihood that each of the potentially visible satellites will be used by the mobile terminal when determining its position based, at least in part, on historical data relating to the probability of a mobile terminal achieving a successful location determination when in the geographical area of the mobile terminal.

55. The computer readable medium of claim 49 wherein in use the computer program causes the processor to determine the likelihood that each of the potentially visible satellites will be used by the mobile terminal when determining its position on a plurality of criteria selected from a group including the following:

an angle of elevation of a satellite relative to the mobile terminal;

a terrain indicator indicative of a terrain type assigned to a geographical area in which the mobile terminal is located;

an elevation model of a geographical area in which the mobile terminal is located;

an geometrical spread of potentially visible satellites in the sky; and

historical data relating to the probability of a mobile terminal achieving a successful location determination when in the geographical area of the mobile terminal.

56. A computer readable medium storing thereon a computer program, said program being configured in use to control the operation of a processor to compile assistance data for transmission to a mobile terminal of a wireless communications network having an associated satellite positioning system receiver, by performing the steps of:

identifying a set of satellites that could potentially be used by the mobile terminal when determining its position and for which assistance data can be sent to the mobile terminal;

5 determining a likelihood that each of the identified satellites will not be used by the mobile terminal when determining its position; and

excluding one or more satellites from the identified set of satellites on the basis of said determined likelihood that the satellites will not be used by the mobile terminal when determining its position; and

10 compiling assistance data for the identified set of satellites for transmission to the mobile terminal.

57. The computer readable medium of claim 56 wherein in use the computer program causes the processor to determine an approximate position of the mobile terminal.

15 58. The computer readable medium of claim 57 wherein the approximate position of the mobile terminal is determined using at least one of the following position indicators associated with the mobile terminal;

cell identification, timing advance, signal strength, round trip time.

20 59. The computer readable medium of claim 58 wherein in use the computer program causes the processor to determine the number of satellites for which assistance data should be transmitted to the mobile terminal.

60. The computer readable medium of claim 59 wherein in use the computer program causes the processor to determine the number of satellites for which assistance data should be transmitted to the mobile terminal, on the basis of one or more of the following criteria:

25 the geometrical spread of potentially visible satellites in the sky;

a terrain indicator indicative of a terrain type assigned to a geographical area in which the mobile terminal is located; and

historical data relating to the probability of a mobile terminal achieving a successful location determination when in the geographical area of the mobile terminal.

61. The computer readable medium of claim 57 wherein in use the computer program causes the processor to exclude satellites from the identified set of satellites on the basis of one or more of the following criteria:

the angle of elevation of a satellite relative to the mobile terminal;

a terrain indicator indicative of a terrain type assigned to a geographical area in which the mobile terminal is located;

an elevation model of a geographical area in which the mobile terminal is located;

the geometrical spread of potentially visible satellites in the sky; and

historical data relating to the probability of a mobile terminal achieving a successful location determination when in the geographical area of the mobile terminal.